Kant and the Laws of Nature

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Michela Massimi

Introduction

Kant's complex and nuanced view on the laws of nature has recently been at the center of renewed attention among Kant's scholars. Kant's view is one of the best examples in the early modern period of the philosophical view of nature as 'ordered' and 'lawful' that emerged with the scientific advancements of the seventeenth and eighteenth centuries. Building on the extraordinary success of Newton's mechanics and optics, but also on the burgeoning chemistry of Hales in England, Boerhaave and Musschenbroek in the Netherlands, among many others, Kant's life-long engagement with the natural sciences (broadly construed) influenced, and fed into his mature Critical philosophy. Explaining why laws of nature seemingly govern the natural world (as much as the moral law regulates the realm of human freedom and choice) is key to Kant's transcendental philosophy. Kant seems to embrace a coherent account of what it is to be a law, in moral philosophy and in theoretical philosophy. When it comes to theoretical philosophy (and in particular, to Kant's philosophy of nature, which is our topic), the main question is how it is possible for us to come to *know* nature as *ordered* and *lawful*. Where does the lawfulness of nature come from? In the *Critique of Pure Reason,* and in the *Prolegomena* Kant held the view that our faculty of understanding is the primary source of nature's lawfulness because the a priori categories of the understanding "prescribe laws to nature" — i.e. they play the role of constitutive a priori principle for our experience of nature. Yet, already in the first *Critique*, and even more so in *Critique of the Power of Judgment* Kant stressed the importance of the faculty of reason, first, and the faculty of reflective judgment then — with their regulative principles — in offering a system of laws necessary for our knowledge of nature. The crucial distinction between constitutive principles of the understanding *versus* regulative principles of reason and reflective judgment leads, in turn, to a series of further distinctions in Kant. For example, it leads to the different status of laws in the physical sciences and in the life sciences, which in turn became the battleground for the debate concerning mechanical explanations versus teleological explanations.

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General Overviews

Friedman 1992 and 2013 has offered a very influential view in this debate (especially with his latest interpretation of Kant's *Metaphysical Foundations*). Guyer 2005 offers an authoritative reading of systematicity in Kant (both in moral philosophy and in theoretical philosophy) and Kitcher 1986 is a classic take on Kant's systematicity by a leading philosopher of science. Massimi 2014 charts the historical roots of Kant's view back to Newton. Warren 2001 provides an insightful metaphysical take on Kant's philosophy of nature. Watkins 2001 and Watkins 2005 are a must for anyone approaching the debate for the first time by a world's leading Kant scholar. Watkins and Stan 2003 (revised 2014)

is an excellent online entry for a detailed overview on Kant's philosophy of science (from the pre-Critical to the Critical period).

Friedman, Michael. "Causal laws and the foundations of natural science." In *The Cambridge Companion to Kant*. Edited by Paul Guyer, 161–199. Cambridge: Cambridge University Press, 1992.
A by now classic article in the field, laying out Friedman's influential reading of Kant on causality and laws.

Friedman, Michael. *Kant's Construction of Nature: A Reading of the Metaphysical Foundations of Natural Science*. Cambridge: Cambridge University Press, 2013.
This is Friedman's latest comprehensive study of Kant's mature view on nature. Advanced reading for an expert audience. The Introduction is accessible to a wider audience.

Guyer, Paul. *Kant's System of Nature and Freedom*. Oxford University Press, 2005.
Authoritative collection of essays on Kant's view on systematicity at work in freedom and nature with a clear discussion of core issues.

Kitcher, Philip. "Projecting the Order of Nature." In *Kant's Philosophy of Material Nature*. Edited by Robert Butts, 201-235. Boston: D. Reidel, 1986.
A classic article in the field – recommended for beginners with an interest in Kantian legacy in philosophy of science.

Massimi, Michela. "Prescribing laws to nature." *Kant-Studien* **105**.4 (2014): 491-508.
A more recent, and historically-oriented article on the cultural milieu and open problems behind Kant's view on the lawfulness of nature.

Warren, Daniel. *Reality and impenetrability in Kant's philosophy of nature.* New York, London: Routledge, 2001.
Short, clear and pioneering book in advancing a metaphysical reading of Kant's philosophy of nature in terms of causal powers.

Watkins, Eric. *Kant and the Sciences.* New York: Oxford University Press, 2001.
An accessible, first-class edited collection covering a comprehensive range of topics within Kant's philosophy of nature. Recommended for advanced undergraduate and graduate seminars.

Watkins, Eric. *Kant and the Metaphysics of Causality* Cambridge: Cambridge University Press, 2005
This is Watkins' influential monograph on some of the core metaphysical issues surrounding causality and causal laws in Kant (with their historical sources).

Watkins, Eric and Stan, Marius. "Kant's Philosophy of Science." *The Stanford Encyclopedia of Philosophy* (2003; revised edition 2014). Edward N. Zalta (ed.). URL = <http://plato.stanford.edu/archives/fall2014/entries/kant-science/>.
A comprehensive introductory essay on metaphysical and epistemological aspects of Kant's philosophy of science, with a particular focus on the philosophy of the physical sciences.

Historical Background on Kant's view of the lawfulness of nature

The next two sub-sections map the ground on the topic of the lawfulness of nature, according to Kant. In Primary Sources, the key Kantian texts on the topic can be found, spanning from the pre-Critical period to the Critical period and the *Opus postumum*. In Secondary Sources, some classic authoritative introductions to the topic are listed, including more recent ones.

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Primary Sources

Kant's reflections on the lawfulness of nature or the laws of nature span from pre-Critical texts to the Critical period up until the *Opus postumum*. Kant 2012 is one of Kant's very first texts in natural science, offering a cosmogony according to Newtonian principles. Kant 1992 tackles the central issue of a dynamical theory of matter and in so doing it anticipates themes further explored in Kant 2004. Kant 1998 is Kant's main text in theoretical philosophy and provides the reader with an overview on the lawfulness of nature and the role of the faculty of understanding in it. Kant 2002 is Kant's own abridged version of Kant 1998, where reflections on the lawfulness of nature and the role of understanding are also reiterated. Kant 2004 is a must for anyone who wants to explore in depth Kant's view on natural science (Chapters on Dynamics and Mechanics are particularly relevant to the topic here). Kant 2000 is very important for Kant's late view on the lawfulness of nature and the role of teleological judgments and purposiveness of nature. Kant 1993 offers insights on how the topic of the lawfulness of nature came to be refined in the light of advancements in the chemical sciences of the time. Kant 2012 is the latest addition to the Cambridge Edition of the Works of Immanuel Kant and includes new translations of classical texts as well as first English translations of some less well-known pre-Critical texts on natural science.

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Kant, Immanuel. *Universal natural history and theory of the heavens.* Translated by Olaf Reinhardt. In *Kant: Natural Science. The Cambridge Edition of the Works of Immanuel Kant.* Edited by Eric Watkins. Cambridge: Cambridge University Press, 2012.

First published in 1755. This is one of the very first work by the young Kant, where a forerunner of Kant's mature dynamical theory of matter is presented, and the nebular hypothesis introduced to explain the origin of the universe.

Kant, Immanuel. *Physical Monadology*. Translated by David Walford and Ralf Meerbote. In *Theoretical Philosophy 1755-1770. The Cambridge edition of the works of Immanuel Kant*. Edited by David Walford and Ralf Meerbote. Cambridge: Cambridge University Press, 1992.

First published in 1756. One of the most important pre-Critical texts to understand Kant's theory of matter and its metaphysical underpinning.

Kant, Immanuel. *Critique of Pure Reason. The Cambridge Edition of the Works of Immanuel Kant.* Edited and translated by Paul Guyer and Allen Wood. Cambridge: Cambridge University Press, 1998.

First edition first published in 1781; second edition first published in 1787. This is of course, Kant's masterpiece in theoretical philosophy. A must for any undergraduate student in philosophy. There Kant offers his view about the faculty of understanding prescribing laws to nature.

Kant, Immanuel. *Prolegomena to any Future Metaphysics*. Translated by Gary Hatfield. In *Theoretical Philosophy after 1781. The Cambridge edition of the works of Immanuel Kant*. Cambridge: Cambridge University Press, 2002.

First published in 1783. The Prolegomena provides a clear and abridged version to core issues presented in the Critique of Pure Reason (incl. Kant's view on the lawfulness of nature).

Kant, Immanuel. *Metaphysical foundations of natural science*. Translated and edited by Michael Friedman. Cambridge: Cambridge University Press, 2004.

First published in 1786. This is Kant's most important Critical work on natural science, covering the four areas of phoronomy, dynamics, mechanics and phenomenology. A must for anyone interested in Kant's view of nature (challenging to read).

Kant, Immanuel. *Critique of the Power of Judgment. The Cambridge Edition of the Works of Immanuel Kant.* Translated by Paul Guyer and Eric Matthews. Cambridge: Cambridge University

Press, 2000.
First published in 1790. This is Kant's third Critique where his mature view on the life sciences, organisms, and teleological explanation are expounded.

Kant, Immanuel. *Opus postumum. The Cambridge Edition of the Works of Immanuel Kant*. Edited by Eckart Förster and Michael Rosen. Cambridge: Cambridge University Press, 1993.
This is a collection of Kant's very late, unpublished comments and reflections on a variety of topics (especially relevant are the sections on chemistry and the ether for Kant's view on the chemical revolution of his time).

Watkins, Eric. *Kant: Natural Science. The Cambridge Edition of the Works of Immanuel Kant.* Cambridge: Cambridge University Press, 2012.
The latest addition to the Cambridge Edition of the Works of Immanuel Kant, with the long-awaited English translation of pre-Critical works such as Kant's very first True estimation of living forces, among others.

Secondary sources

Adickes 1924 is one of the first systematic studies of Kant's philosophy of nature. Buchdahl 1969 provides the reader with an introduction to the wider historical and philosophical context for Kant's view on nature in the early modern period. Ameriks 2012 offers an overview on the legacy of Kant's view for post-Kantian German philosophy. Butts 1986 and Brittan 1978 are now classic texts in the field, excellent especially for an introduction to Kant's view on the physical sciences. Plaass 1965 is one of the first critical studies of the Preface of Kant's *Metaphysical Foundations of Natural Science*. Friedman 1992 is a seminal text by a contemporary leading scholar, offering a detailed study of Kant's philosophy of natural science. Schönfeld 2000 is excellent in providing a short but comprehensive introduction to various aspects of Kant's pre-Critical natural science. Zammito 1992 offers a critical study of Kant's third Critique and the development of Kant's view vis-à-vis debates in the philosophy and the life sciences of the time.

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Adickes, Erich. *Kant als Naturforscher*. Berlin: de Gruyter, 1924.
A classic (although a bit dated) treatment of Kant's philosophy of nature.

Ameriks, Karl. *Kant's Elliptical Path*. Oxford University Press, 2012.
An authoritative collection of essays covering a variety of aspects, with a focus both on the historical context and the legacy on German idealism. Especially relevant are the First Section on Kant's first Critique and the Third Section on purposiveness in Kant.

Buchdahl, Gerd. *Metaphysics and the Philosophy of Science*. Oxford: Basil Blackwell, 1969.
A landmark for any undergraduate student in philosophy of science interested in Kant and his legacy for contemporary debates. Clear and accessible.

Butts, Robert E. ed. *Kant's Philosophy of Physical Science*. Dordrecht: D. Reidel, 1986.
An excellent collection of essays, featuring some classic articles such as Kitcher 1986.

Brittan, Gordon J. *Kant's Theory of Science*. Princeton University Press, 1978.
A classic and comprehensive treatment of the development of Kant's philosophy of nature in the Critical period. Accessible for undergraduate students.

Friedman, Michael. *Kant and the Exact Sciences*. Harvard University Press, 1992.
Another landmark in the field, presenting Friedman's influential interpretation of Kant's natural science. Particularly interesting is Part Two on Kant's Opus Postumum and reflections on the

burgeoning chemistry and its impact on Kant's view on the lawfulness of nature. Suitable for advanced graduate seminars.

Plaass, Peter. *Kants Theorie der Naturwissenschaft.* Göttingen: Vandenhoeck U. Ruprecht, 1965.
This is one of the first important studies on Kant's *Metaphysical Foundations of Natural Science*, offering an interpretive analysis of the Preface.

Schönfeld, Martin. *The Philosophy of the Young Kant*. New York: Oxford University Press, 2000.
A clear, concise and helpful book summarizing the main pre-Critical works of Kant. Helpful source for navigating Kant's work on the natural science and its historical context.

Zammito, John. *The Genesis of Kant's Critique of Judgment*. Chicago: University of Chicago Press, 1992.
Helpful overview of the development of Kant's ideas in the third Critique in their historical context. Recommended for advanced undergraduate classes.

Kant on the lawfulness of nature

Buchdahl 1965 and Friedman 2014 defend alternative views on the nature of causal laws. Kitcher 1986 and Kreines 2009 are two examples of how to read Kant's view on the lawfulness of nature through the lenses of contemporary discussions in philosophy of science about laws. Chignell 2014 and Pollok 2014 place Kant's view in the broader epistemological and historical context. Watkins 2007 and Watkins 2014 offer some of the best and more thorough introduction to the topic.

Buchdahl, Gerd. "Causality, Causal Law, and Scientific Theory in the Philosophy of Kant." *British Journal for the Philosophy of Science* 16 (1965): 187-208.
An influential reading of Kant to get to grips with some of the controversy surrounding causal laws.

Chignell, Andrew. "Proof of Real Possibility: Cognition, the Laws, and a Coherence Constraint on Knowledge." *Kant-Studien* 105 (2014): 573-97.
A cutting-edge study on the role of laws of nature in Kant's epistemology.

Friedman, Michael. "Laws of Nature and Causal Necessity." *Kant-Studien* 105 (2014): 531-53.
This is Friedman's latest treatment on the thorny topic of causal laws and necessity. Suitable for a specialist audience already familiar with Friedman's work.

Kitcher, Philip. "The Unity of Science and the Unity of Nature." In *Kant and Contemporary Epistemology.* Edited by Paolo Parrini, 253-272. Dordrecht: Kluwer, 1994.
This article further develops Kitcher's 1986 take on systematic unity in Kant and its legacy for contemporary philosophy of science.

Kreines, James. "Kant on the Laws of Nature and the Limitation of our Knowledge," *European Journal of Philosophy*, 17 (2009): 527-58.
One of the best, recent treatments of Kant's view on laws. Suitable for graduate seminars.

Pollok, Konstantin. "'The Understanding Prescribes Laws to Nature': Spontaneity, Legislation, and Kant's Transcendental Hylomorphism." *Kant-Studien*, 105 (2014): 509-30.
A sophisticated, advanced interpretive reading on Kant's view on the lawfulness of nature. Suitable for a specialist audience.

Watkins, Eric. "What is, for Kant, a Law of Nature?" *Kant-Studien*, 105 (2014): 271-290.

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A clear, accessible introduction to Kant's unified and coherent view about what makes something a law of nature. Suitable for beginners.

Watkins Eric. "Kant on Transcendental Laws," in *Thinking about Causes*. Edited by Peter Machamer & Gereon Wolters, 100-122. Pittsburgh: Pittsburg University Press, 2007.

Excellent and clear introduction to the complex issue of the relation between transcendental laws of the understanding and empirical laws of nature, both in their historical context and contemporary legacy

Constitutive principles of the understanding and empirical laws

Friedman 1992, O'Shea 1997, Watkins 2010 are landmark readings to understand Kant's notion of constitutive principles. Watkins 2000 and Watkins 2013 elaborate further on other kinds of laws Kant seemed committed to defend, and on the distinction between constitutive and regulative principles.

Friedman, Michael. "Regulative and Constitutive." *The Southern Journal of Philosophy* 30 (1992): 73-102.

A classic introductory text to this key conceptual distinction in Kant.

O'Shea, James. "The Needs of Understanding: Kant on Empirical Laws and Regulative Ideals." *International Journal of Philosophical Studies*, 5 (1997): 216-54.

Clear and accessible article that elaborates on the debate surrounding the constitutive demands of the faculty of understanding and the regulative nature of reason.

Watkins, Eric. "Kant on Rational Cosmology." In *Kant and the Sciences*. Edited by Eric Watkins, 70-89. New York: Oxford University Press, 2000.

An interesting study of Kant's laws of rational cosmology across the first Critique and the lectures on metaphysics, with a focus on their historical sources in Baumgarten et al. Advanced specialist reading.

Watkins, Eric. "Kant on *Infima Species*." In *Kant und die Philosophie in weltbürgerlicher Absicht*, vol. V. Edited by Stefano Bacin, Alfredo Ferrarin, Claudio La Rocca and Margit Ruffing, 283-294. Berlin: de Gruyter, 2013.

Another specialist reading by a leading Kant scholar with a focus on Kant's logic and his take on systematicity as a regulative principle of reason.

Watkins, Eric. "The System of Principles." In *The Cambridge Companion to Kant's Critique of Pure Reason*. Edited by Paul Guyer, 151-167. New York: Cambridge University Press, 2010.

Clear and accessible introduction to Kant's architectonics for the faculty of understanding and its role for the lawfulness of nature.

Regulative principles: systematicity and purposiveness

Banham 2013, McLaughlin 2014, Guyer 1990 and Guyer 2003 offer each a very helpful introduction to the issue by mapping the terrain either in historical terms or in terms of Kant's overall transcendental philosophy. Floyd 1998, Geiger 2003, Godlove 2013, Grier 1997 provide different interpretive angles on the topic.

Banham, Gary. "Regulative Principles and Regulative Ideas." In *Proceedings of the Eleventh International Kant Congress,* vol. 2, pp. 15-24. Berlin De Gruyter, 2013.

Compares Kant's use of "regulative" in the Ideas of Pure Reason and in the Analogies of Experience. Clear and helpful reading.

Floyd, Juliet. "Heautonomy: Kant on Reflective Judgment and Systematicity." In *Kant's Ästhetik –*

Kant's Aesthetics – L'esthétique de Kant. Edited by Herman Parret, 192-218. Berlin and New York: Walter de Gruyter, 1998.
A classic article on the topic – ideal for graduate classes.

Geiger, Ido. "Is the Assumption of a Systematic Whole of Empirical Concepts a Necessary Condition of Knowledge?" *Kant-Studien* 94 (2003): 273-98.
Another scholarly article suitable for advanced graduate seminars on the topic.

Huneman, Philippe. *Understanding Purpose: Kant and the Philosophy of Biology.* NAKS Studies in Philosophy. University of Rochester Press.
Tackles Kant's purposiveness within the broader context of the history of science and its philosophical legacy.

Grier, Michelle. "Kant on the Illusion of a Systematic Unity of Knowledge." *History of Philosophy Quarterly* 14.9 (1997): 1-28.
A landmark in the debate on systematic unity – specialist reading.

Guyer, Paul. "Reason and Reflective Judgment: Kant on the Significance of Systematicity." *Noûs* 24 (1990): 17-43.
This is a classic article that offers an interpretive explanation of why Kant came to re-assign the regulative principle of systematicity from the faculty of reason (in the first Critique) to the faculty of reflective judgment (in the third Critique).

Guyer, Paul. "Kant on the Systematicity of Nature: Two Puzzles." *History of Philosophy Quarterly* 20 (2003): 277-95.
Elaborates on Guyer's influential reading of the principle of systematicity.

McLaughlin, Peter. "Transcendental Presuppositions and Ideas of Reason," *Kant-Studien*, 105 (2014): 554-72.
Places Kant's view on systematicity in his intellectual and historical context.

Kant and the Laws of Physics

Kant's view on the laws of physics is a fascinating and multi-faceted topic. The following two sub-sections offer an overview on laws in mechanics and Kant's view on chemistry and dynamical theory of matter. There are important differences between these two areas. For while Kant clearly thought that there are laws in mechanics, he did not think that chemistry enjoyed the same degree of lawfulness as physics (indeed, in the *Metaphysical Foundations of Natural Science*, he called chemistry a "systematic art" rather than a proper science). Hence, the two areas deserve separate treatments.

Laws in mechanics

Massimi–De Bianchi 2013, Stan 2009 and Stan 2013 contextualise Kant's view on the laws of mechanics in its historical-cultural milieu. Carrier 2001, and Watkins 1997, Watkins 1998a, Watkins 1998b and Watkins 2013 investigate the role of this kind of laws in Kant's transcendental philosophy and engagement with Newtonian science.

Carrier, Martin. "Kant's mechanical determination of matter in the *Metaphysical Foundations of Natural Science*." In *Kant and the Sciences*. Edited by Eric Watkins, 117–135. New York: Oxford University Press, 2001.
Addresses key issues for Kant's theory of matter in the Critical period.

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Massimi, Michela and De Bianchi, Silvia. “Cartesian echoes in Kant’s philosophy of nature.” *Studies in History and Philosophy of Science* 44 (2013), 481–492.

A more historically-focused article on the relation between mechanics and dynamics in Kant.

Stan, Marius. “Kant’s early theory of motion: Metaphysical dynamics and relativity.” *The Leibniz Review* 19 (2009): 29–61.

A historical overview on the sources behind Kant’s mechanics in the pre-Critical period by a promising Kant scholar. Ideal for graduate students in history of science.

Stan, Marius. “Kant’s third law of mechanics: The long shadow of Leibniz.” *Studies in History and Philosophy of Science* 44 (2013): 493–504.

Thorough reconstruction of the historical development of Kant’s third law of mechanics. Advanced reading.

Watkins, Eric. “The Laws of Motion from Newton to Kant.” *Perspectives on Science* 5 (1997): 311-348.

Argues that there are important differences between Kant’s laws of mechanics and Newton’s laws of motion, despite similarities and the temptation to read the former as a philosophical justification for the latter.

Watkins, Eric. “The Argumentative Structure of Kant’s *Metaphysical Foundations of Natural Science*.” *Journal of the History of Philosophy* 36 (1998a): 567-593.

Offers a systematic reinterpretation of a standard received view that has long read Kant’s *Metaphysical Foundations of Natural Science* against the background of Newtonian mechanics,

Watkins, Eric. “Kant’s Justification of the Laws of Mechanics.” *Studies in History and Philosophy of Science* 29 (1998b): 539-560.

Detailed interpretive analysis of Kant’s three laws of mechanics in the *Metaphysical Foundations of Natural Science* in their historical context of German (Leibnizian-Wolffian) philosophy. Recommended reading for anyone who wants to get a well-rounded view on Kant’s laws of mechanics.

Watkins, Eric. “The Early Kant’s (Anti-) Newtonianism.” *Studies in History and Philosophy of Science Part A* 44.3 (2013): 429-37.

This latest paper elaborates and expands on Watkins’s interpretive take on Newton’s influence for Kant, with a focus on the pre-Critical Kant of *Universal Natural History*.

Kant’s dynamical theory of matter and chemistry

Förster 2000 and Edwards 2000 are each a detailed monograph that addresses Kant’s dynamical theory of matter in the context of Kant’s overall architectonic and project. Massimi 2011 and Carrier 1990 draw attention to the historical context and background behind Kant’s theory of matter. Smith 2013a and Smith 2013b elaborate on metaphysical aspects of Kant’s view and its background sources, esp. in response to Warren 2010’s recent influential reading.

Edwards, Jeffrey. *Substance, force, and the possibility of knowledge. On Kant’s philosophy of material nature*. Berkeley: University of California Press, 2000.

Tracks the development of Kant’s dynamical theory of matter from the pre-Critical period, through the Critical period and the *Opus postumum*.

Massimi, Michela. “Kant’s dynamical theory of matter in 1755, and its debt to speculative Newtonian

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experimentalism." *Studies in History and Philosophy of Science* 42 (2011): 525–543.
Traces the origins of Kant's matter theory in the British and Dutch Newtonianism of the early eighteenth century. Suitable for students in history and philosophy of science.

Smith, Sheldon. "Does Kant have a pre-Newtonian picture of force in the balance argument? An account of how the balance argument works." *Studies in History and Philosophy of Science Part A* 44.3 (2013a): 470–480.
This is a response to Dan Warren's 2010 article on the topic.

Smith, Sheldon. 2013. "Kant's picture of monads in the *Physical Monadology*", *Studies in History and Philosophy of Science Part A* 44.1 (2013b): 102-111.
Sophisticated interpretive reading of Kant's metaphysics of nature – advanced reading.

Schönfeld, Martin. ''Kant's early dynamics''. In *A Companion to Kant*. Edited by Graham Bird, 33–46. Blackwell Publishing, 2006.
Schönfeld provides a very readable overview on the topic – suitable for undergraduate students.

Warren, Daniel. "Kant on attractive and repulsive force: The balancing argument". In *Discourse on a new method. Reinvigorating the marriage of history and philosophy of science*. Edited by Mary Domski and Michael Dickson, 193–241. Chicago & La Salle: Open Court Publishing, 2010.
Sustained critical study on Kant's main argument for Dynamics in the Metaphysical Foundations. Recommended reading.

Carrier, Martin. "Kants Theorie der Materie und ihre Wirkung auf die zeitgenössische Chemie". *Kant-Studien* 81 (1990): 170–210.
An important contribution to the understanding of Kant's controversial take on chemistry as a "systematic art".

Förster, Eckart. *Kant's Final Synthesis: An Essay on the* Opus postumum. Cambridge, Massachusetts: Harvard University Press, 2000.
Excellent introductory book on the *Opus Postumum*. Particularly relevant is Ch. 4 on the ether proof and its overall role in Kant's late view on chemistry.

Kant and the Laws of the Life Sciences

Kant's view on the laws of the life sciences differs in remarkable ways from his view on the laws in the physical sciences. In this final Section, some classic resources for the historical background of Kant's view on biology can be found. In addition, the reader will also find a selection of texts that tackle more directly both the issue of what is an organism for Kant, and the further issue of how explanations in the life sciences differ from mechanical explanations in the physical sciences.

Historical background

Wilson 2005 and Sloan 2006 place Kant's view in its historical context and background sources. Richards 2000 and Zammito 2012 offer responses to Lenoir 1980's influential reading of the Kant–Blumenbach relation.

Lenoir, Timothy. "Kant, Blumenbach and Vital Materialism in German Biology." *Isis* 71 (1980): 77-108.
Influential (albeit controversial) historical analysis on the reciprocal influence between Kant's view of organic form in the third Critique, and the anthropologist Blumenbach's view on natural history.

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Richards, Robert. "Kant and Blumenbach on the *Bildungstrieb*: A Historical Misunderstanding." *Studies in History and Philosophy of Biological and Biomedical Sciences* 31 (2000): 11–32.

Influential critical re-reading of the alleged reciprocal influence of Kant and Blumenbach. Ideal for advance graduate seminars in history of science.

Sloan, Philip R. "Kant on the History of Nature: The Ambiguous Heritage of the Critical Philosophy for Natural History." *Studies in History and Philosophy of Biological and Biomedical Sciences* 37 (2006): 637–648.

Methodological analysis of Kant's natural history in its historical context.

Zammito, John. "The Lenoir Thesis Revisited: Blumenbach and Kant." *Studies in History and Philosophy of Biological and Biomedical Sciences* 43 (2012): 120-132.

Critical evaluation of Lenoir 1980 suggesting a re-appraisal of the Kant-Blumenbach relation and its overall influence on the German life sciences of the end of eighteenth century.

Wilson, Catherine. "Kant and the Speculative Sciences of Origins." In *The Problem of Animal Generation in the 17th and 18th Centuries*. Edited by Justin E.H. Smith, 375-401. Cambridge: Cambridge University Press, 2005.

Fascinating historical journey through Kant's view of organic evolution.

Organisms and purposiveness

Goy and Watkins 2014 is an authoritative edited collection on the topic. Ginsborg 2015, and Zuckert 2007 tackle the issue of purposiveness in the broader context of Kant's overall project in the third *Critique*. McLaughlin 1990, Mensch 2013, and Quarfood 2004 offer comprehensive treatments of Kant's view on organisms. Breitenbach 2009 and Breitenbach 2014 display a contemporary interpretive take on Kant's view of living organisms and its ongoing relevance.

Breitenbach, Angela. *Die Analogie von Vernunft und Natur*. Berlin/New York: de Gruyter, 2009.

Systematic and comprehensive study of Kant's philosophy of biological phenomena.

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State of the art collection in the area – recommended reading for advanced graduate seminars in the field.

Ginsborg, Hannah. *The Normativity of Nature: Essays on Kant's* Critique of Judgement. Oxford: Oxford University Press, 2015.

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Mensch, Jennifer. *Kant's Organicism*. Chicago, University of Chicago, 2013.
Interpretive take on Kant's critical philosophy through the lenses of the history and philosophy of the life sciences of his time. Advanced reading.

Zuckert, Rachel. *Kant on Beauty and Biology*. Cambridge: Cambridge University Press, 2007.
A classic monograph on the unity and continuity between aesthetic judgment and teleological judgment in Kant's third Critique.

Teleological explanation versus mechanical explanation

McLaughlin 2003, McLaughlin 2014 and Watkins 2009, Watkins 2014 are very helpful in mapping the ground on this important distinction. Ginsborg 2004 contrasts Kant's view with some influential preceding views on the topic. Breitenbach 2006, Breitenbach 2008, Breitenbach 2009 are particularly relevant to explore the ongoing relevance of Kant's view for contemporary philosophy of biology.

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Dissects different meanings for mechanical laws in the third Critique and defends the view that mechanical laws should be understood along the lines of mechanical part-whole interactions.

Watkins, Eric. "The Antinomy of Teleological Judgment." *Kantian Yearbook* 1 (2009): 197-221.
Discusses the origins of the antinomy of teleological judgment and argues for the philosophical inadequacy of various interpretations of it.

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Watkins, Eric. “Nature in General as a System of Ends.” In *Kant’s Theory of Biology*. Edited by Ina Goy and Eric Watkins, 117-130. Berlin: De Gruyter, 2014.

Extends Kant’s view on teleological judgments beyond organisms, as applying to nature in general.

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